2007

ZOOLOGY

PAPER-11 (Group -A)

*Full Marks* :50

*Time :* 2 hours

Answer any **four questions taking two from** each Unit

*The figures in the right-hand margin indicate marks*

*Candidates are required to give their answers in their own words as far as practicable*

Write the **answers Questions of each Unit in separate books**

UNIT-I

*( Cytogenetics)*

**1. (a) Which bacterial genetic transfer process does not require recombination** with the **bacterial chromosome?**

(b) Crosses of three different Hfr strains with separate samples of an F` strain are carried out,

and the following mapping data are provided from studies of interrupted conjugation:

**Appearence of genes in F- cell**

| | | | | | | |
|---|---|---|---|---|---|---|
| Hfr 1 : | Genes | | | c+ | f+ | g+ |
| | Time | 3 | 5 | 16 | 27 | 59 |
| Hfr 2 | Genes | c+ | f+ | c+ | d+ | b+ |
| | Time | 6 | 24 | 35 | 46 | 48 |
| Hfr 3 | Genes | d+ | c+ | f+ | c+ | g+ |
| | Time | 4 | 15 | 26 | 44 | 58 |

**Construct a genetic map for, these genes, indicating their order on the bacterial chromosome and the distances between them.**

**(c) What types of matings are possible between F+,** F-, Hfr and F cells? **What outcome do these matings** produce? What is the role of F factor in conjugation?

(*d*) How are F' factors formed? $2 + 5\frac{1}{2} + 3\frac{1}{2} + 1\frac{1}{2}$

2. (a) Phages with r II mutations can not produce plaques in E. Coil K 12 (1.) , but wild type phages can. From an experimental point of view, explain why this observation is so significant.

(b) Explain how Benzer's results indicated that a **gene is not an indivisible unit.**

(c) Here are data from several implementation expts., involving rapid-lysis mutations in genes nil A and rIIB. The strain designated L51 is **known to have a mutation in r II B.**

| **Phage mixture** | **Complementation** |
|---|---|
| L91 and L65 | No |
| L65 and L62 | No |
| L33 and L47 | Yes |
| L40 and L51 | No |
| L47 and L92 | No |
| L51 and L47 | Yes |
| L51 and L92 | Yes |
| L33 and L40 | No |
| L91 and L92 | Yes |
| L91 and L33 | No |

**List which groups of mutations are in the riA gene and which groups are in the r 11 B gene.**

3+3+61
2

**3. (a) In an island population, the following data were obtained regarding the numbers** of people with **each of the** four blood types :

Type 0-721; Type A-932, Type B-235, Type AB-112.

**Is this population in Hardy-Weinberg equilibrium ? Explain your answer.**

**( b) In a large herd of 5, 468 sheep, 76 animals have yellow fat, compared to the rest of the members of the herd, which have white fat.** Yellow fat **is inherited as a recessive trait. It is assumed that this herd is in Hardy-Weinberg equilibrium.**

**(i) What are the frequencies of the white and yellow fat alleles in this population?**

***(ii)*** **Approximately how many sheep with white fat are heterozygous carriers of the yellow**

4. **(a) Mention the special features of long terminal repeat** (LTR) of **most** retroviruses.

(b) What do you mean by transducing retroviruses. Give two examples. How a transducing retrovirus is formed?

(c) What is the difference between a replicative and a conservative transposon? How does a replicative transposon more? Describe the process with proper illustration.

2.+(Z+3)+(2+3 1)
2

## UNIT II

*(Molecular Biology)*

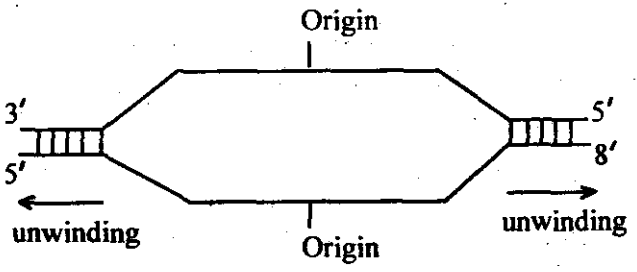
5. (a) The following diagram represents a DNA molecule that is undergoing replication. Draw in the strands of newly synthesized DNA and identify the following items :

(i) Polarity of newly synthesized strands

*(ii)* Leading and lagging strands

*(iii)* Okazaki fragments

(*iv*) RNA primers.




(**b) What would be the effect on DNA replication of mutations that destroyed each of the following activities in DNA polymerase I?**

**(i) 3'-s' 5' exonuclease** activity

*(ii)* 5' **3' exonuclease** activity

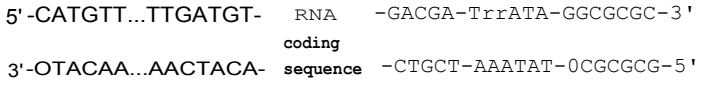
*(iii)* 5' **3' polymerase** activity.

**(c) Illustrate** the *Ori* complex in E. *Coi*

(d) Formation **of replisome is a multistep process and involves several regulatory protein.** Discuss.

4+2+2+4½

6. (a) The following diagram represents a sequence of nucleotides surrounding an RNA coding **sequence.**




(i) Is the RNA-**coding sequence** likely to be from a bacterial cell or from a eukaryotiic **cell ? How** can you tell ?

*(ii)* Which DNA strand will serve as the **template strand during the transcription of** the RNA **coding sequence ?**

( **b) Suppose that a consensus sequence in the regulatory promoter of a gene ,that enzyme** A were deleted. Which of the following effects **would result?**

(i) Enzyme A would have **a different amino acid sequence.**

*(ii)* The mRNA for enzyme A would be abnormally short.

*(iii)* Enzyme A would be missing some amino acids.

*(iv)* The mRNA **for enzyme** A would be **transcribed but not translated.**

**( v) The amount of mRNA transcribed would be affected . Explain your reasoning.**

**(c) List at least three properties** that DNA **polymerases and RNA polymerases have in common. List at least three differences.**

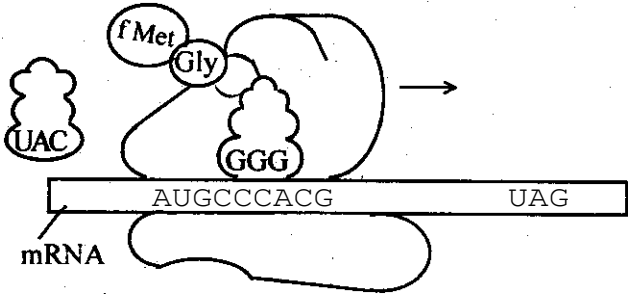
**( d) What is the role of Nus A protein in transcription.**

5+2 $\frac{1}{2}$ +3+2

**7. (a) Arrange the following components of translation in the approximate order in which they would appear in protein synthesis:**

**70 S initiation complex**
**release factor I**
**peptidyl transferase**
**elongation** factor G
30 S initiation complex
**elongation** factor Tu
**initiation** factor 3
f Met-tRNAf^'Ie'

(b) The following diagram illustrates a step in the process of translation.




**Sketch the diagram and** identify the following **element on it.**

(**i) 5' and 3' end of the mRNA.**

***(ii)*** **A,PandEsites.**

(***iii)*** **Start codon and stop codon.**

***(iv)*** **Amino and carboxyl ends** of the newly synthesized polypeptide chain.

(v) Place on the ribosome where **release** factor I will bind.

*( vi)* What will be the anticodon of the next tRNA added to the A site of the **ribosome?**

**(c) Outline in words and pictures how telomeres at the ends of eukaryotic chromosomes are replicated ?**

( **d) Translation** usually initiates at an AUG codon **near the 5' end of an** mRNA, **but mRNA often have multiple** AUG triplets **near their 5' ends. How is the initiation** AUG codon **correctly identified in prokaryotes and eukaryotes?**

2+3+4 1+3
2

8. (a) What effect will deletion of the trpL region of the trp operon have on the rates of synthesis of the enzymes encoded by the five genes in the trp operon in E. Coli cells growing in the presence of tryptophan ?

( b) Why is presence of glucose, lac operon transcription never exceeds 2 per cent of the induced rate observed in the absence of glucose ?

(c) In a hypothetical E. Coli operon the regulator **gene is closely linked to a region containing two structural genes and an operator. In table, the regulator, the operator, and a structural gene are listed in correct sequence.** The ability of **each of the indicated genotypes to synthesize an enzyme under induced and noninduced conditions is as shown.** Which of **these genes is the operator, the regulator and the structural gene ? Explain the reason for your selection.**

| Genotypes | Phenotypes | |
|---|---|---|
| | Inducer absent | Inducer present |
| $a^- b^+ c^+$ | S | S |
| $a^+ b^+ c^-$ | S | S |
| $a^+ b^- c^-$ | s | s |
| $a^+ b^- c^+ / a^- b^+ c^-$ | S | S |
| $a^+ b^+ c^+ / a^- b^- c^-$ | S | S |
| $a^+ b^+ c^- / a^- b^- c^+$ | S | S |
| $a^- b^+ c^+ / a^+ b^- c^-$ | S | S |

*Note :* **S = enzyme synthesized in normal quantities**
**s = little or no synthesis.**

$2\frac{1}{2} + 3 + 7$